Donuts

Joe Silber ...the one talkin' at ya

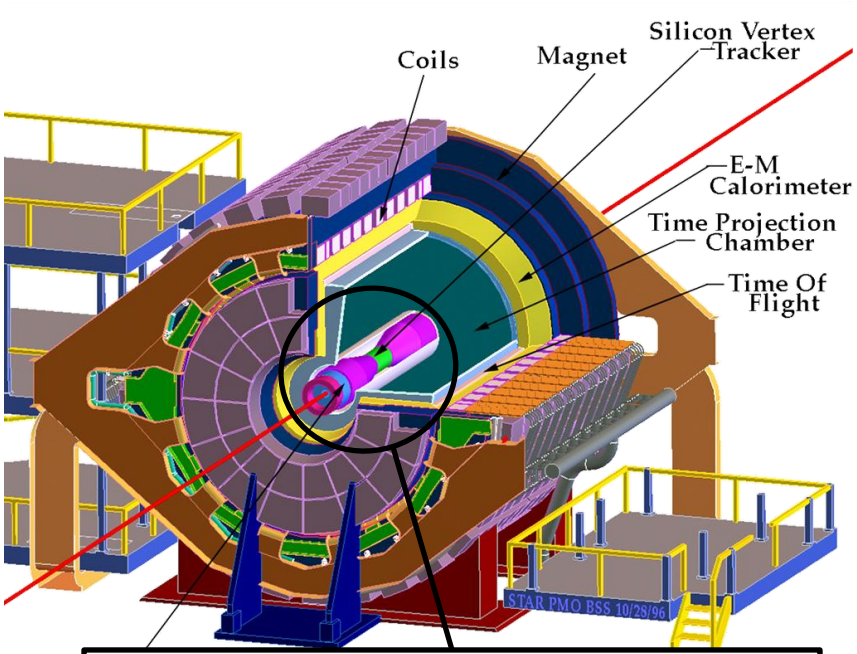
Eric Anderssen, Howard Wieman, Murdock Gilchriese, Mario Cepeda, Tom Johnson, Maurice Garcia-Sciveres, Neal Hartman, Ken Wilson, Eric Phillips, Christoph Schenk
…other folks working a lot on the structures I'll talk about

2011-05-10

Some Detector Structures In the Works

STAR Heavy Flavor Tracker

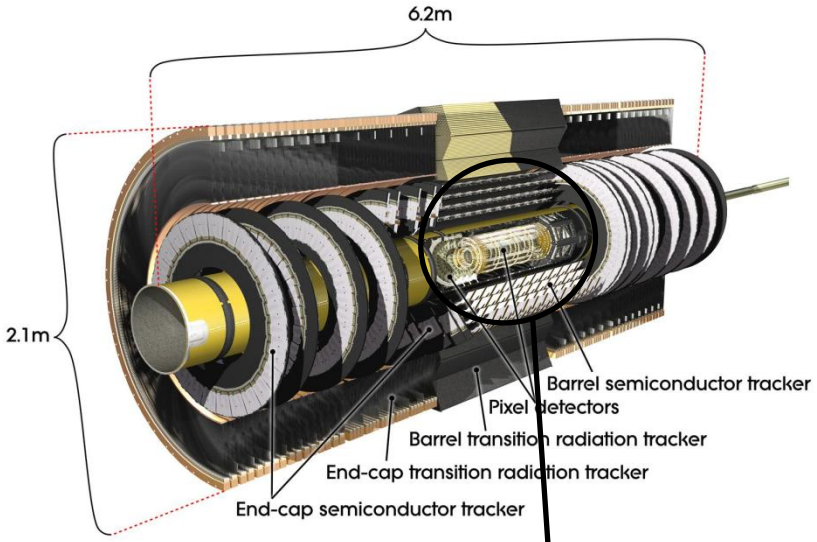
Relativistic Heavy Ion Collider (RHIC) in Brookhaven



LBL currently building the entire inner detector structure. First stage of installation this summer, second stage in 2013.

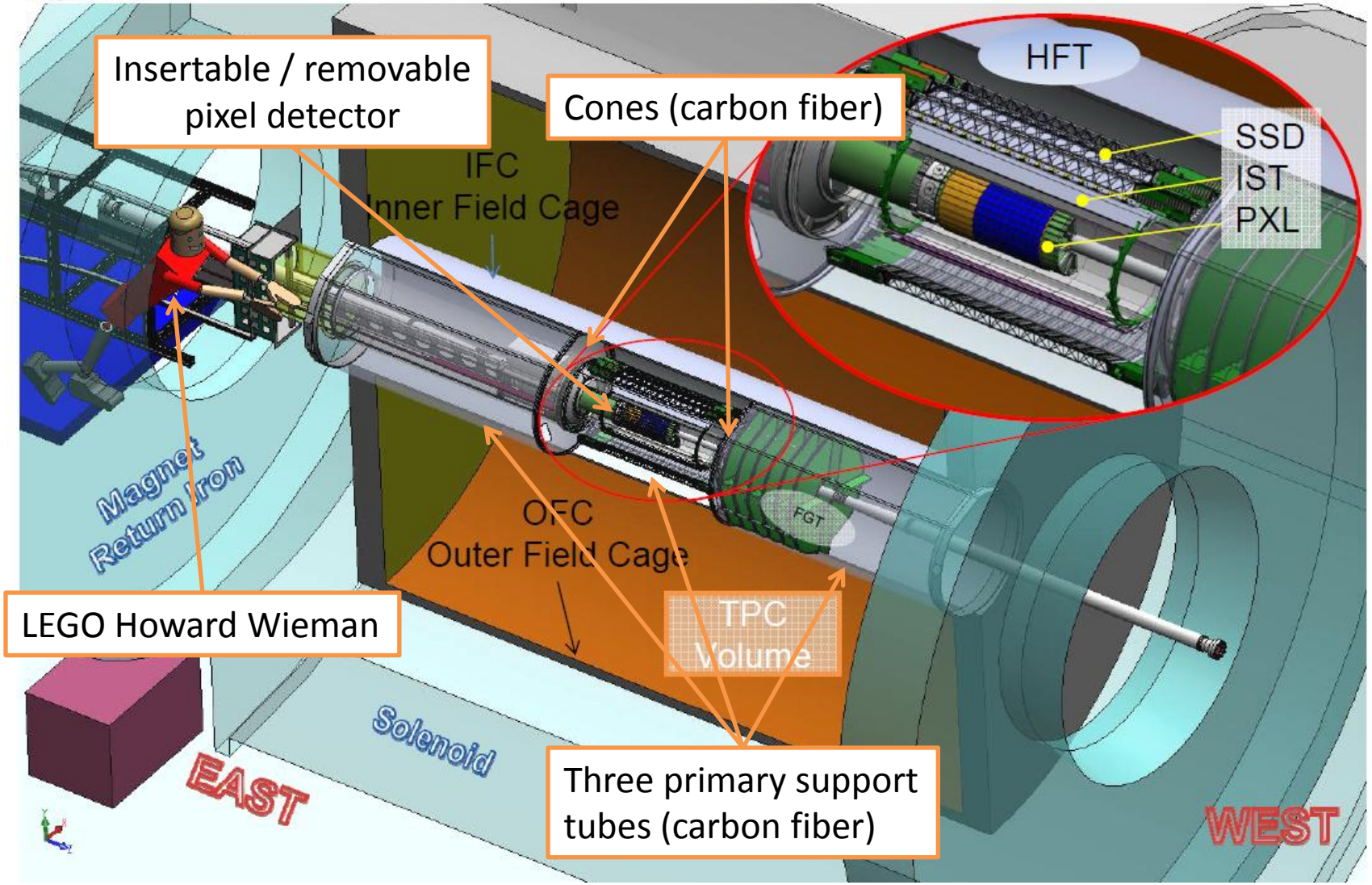
ATLAS Upgrade

Large Hadron Collider (LHC) in Geneva

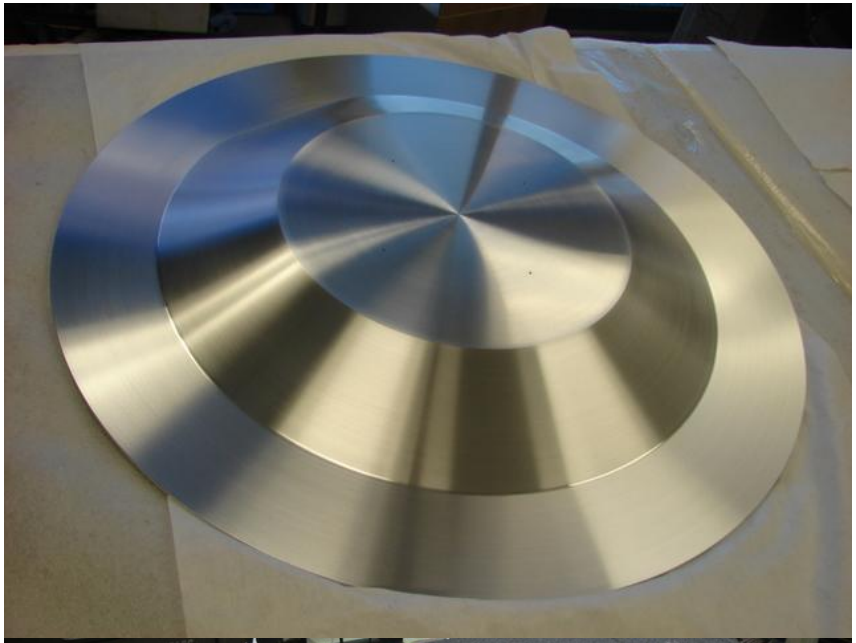


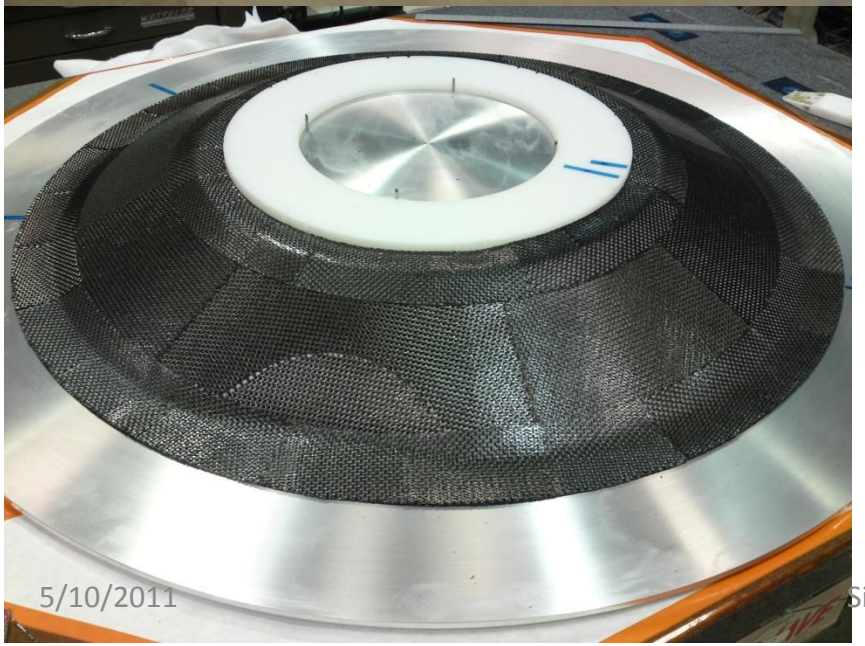
LBL involved heavily in current pixel and barrel upgrades R&D. Likely to be building key structures in the future (a few years).

HFT Detector within STAR IFC

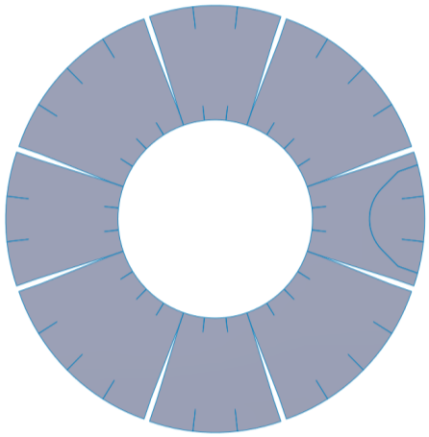


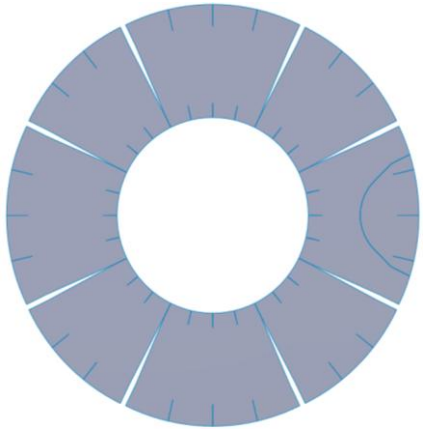
STAR IDS – Carbon fiber cone layup





Ply shape design…



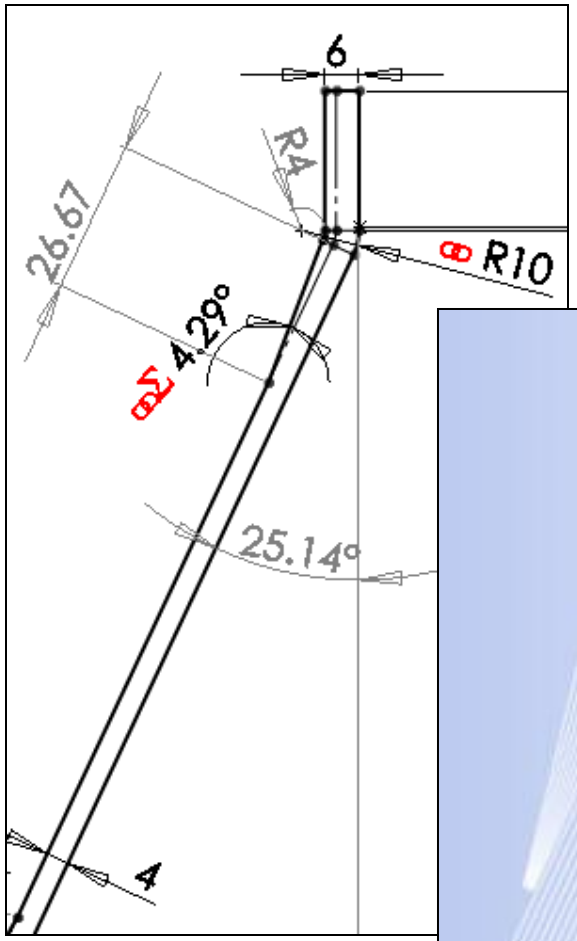


Stackup and Plies To Cut Out

STACKUP				PLIES TO CUT OUT									
				A			B			inner and outer radius pieces all flanges			
Ply Number	Layout / Ply Shape	Fiber Angle (As Cut)	Flange Ply Clocking	*Wedge*	*WedgeMinusFlat*	*Flat*	*Wedge*	*WedgeMinusFlat*	*Flat*	*Flange 1*	*Flange 2*	*Flange 3*	*Flange 4*
0 ?	Glass+Resin?												
1	Layout 1	±45		3	1	1	4						
2	Flange 4	±45	~0.0°							8			
3	Layout 1	0/90		3	1	1	4						
4	Layout 2	±45		4			3	1	1				
5	Flange 4	0/90	~0.0°							8			
6	Layout 2	0/90		4			3	1	1				
7	Layout 1	±45		3	1	1	4						
8	Flange 3	±45	~3.5°								8		
9	Layout 1	0/90		3	1	1	4						
10	Layout 2	±45		4			3	1	1				
11	Flange 3	0/90	~3.5°								8		
12	Layout 2	0/90		4			3	1	1				
13	Layout 1	0/90		3	1	1	4						
14	Flange 2	0/90	~7.0°									8	
15	Layout 1	±45		3	1	1	4						
16	Layout 2	0/90		4			3	1	1				
17	Flange 2	±45	~7.0°									8	
18	Layout 2	±45		4			3	1	1				
19	Layout 1	0/90		3	1	1	4						
20	Flange 1	0/90	~10.5°										8
21	Layout 1	±45		3	1	1	4						
22	Layout 2	0/90		4			3	1	1				
23	Flange 1	±45	~10.5°										8
24	Layout 2	±45		4			3	1	1				
25	Antistatic												

Totals to Cut for One Cone Part:		
	Wedge A	28x @ 0/90 and 28x @ ±45
	Wedge B	28x @ 0/90 and 28x @ ±45
	WedgeMinusFlat A	4x @ 0/90 and 4x @ ±45
	WedgeMinusFlat B	4x @ 0/90 and 4x @ ±45
	Flat A	4x @ 0/90 and 4x @ ±45
	Flat B	4x @ 0/90 and 4x @ ±45
	Flanges	8x (inner flange) and 8x (outer flange) @ 0/90 in all four sizes
	Flanges	8x (inner flange) and 8x (outer flange) @ ±45 in all four sizes
	Filler	8x @ 0/90 and 8x @ ±45
	FlangeFiller	For both inner and outer flange pieces, 4x @ 0/90 and 4x @ ±45

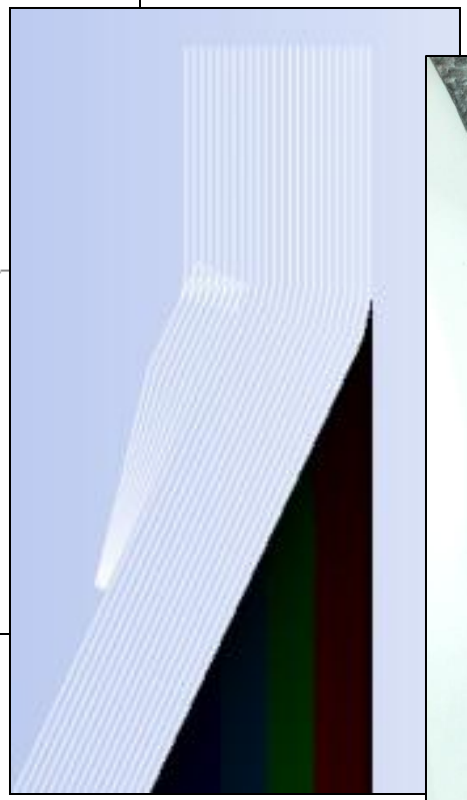
Features like tapered cross-section (useful at bolt flange) are natural to do

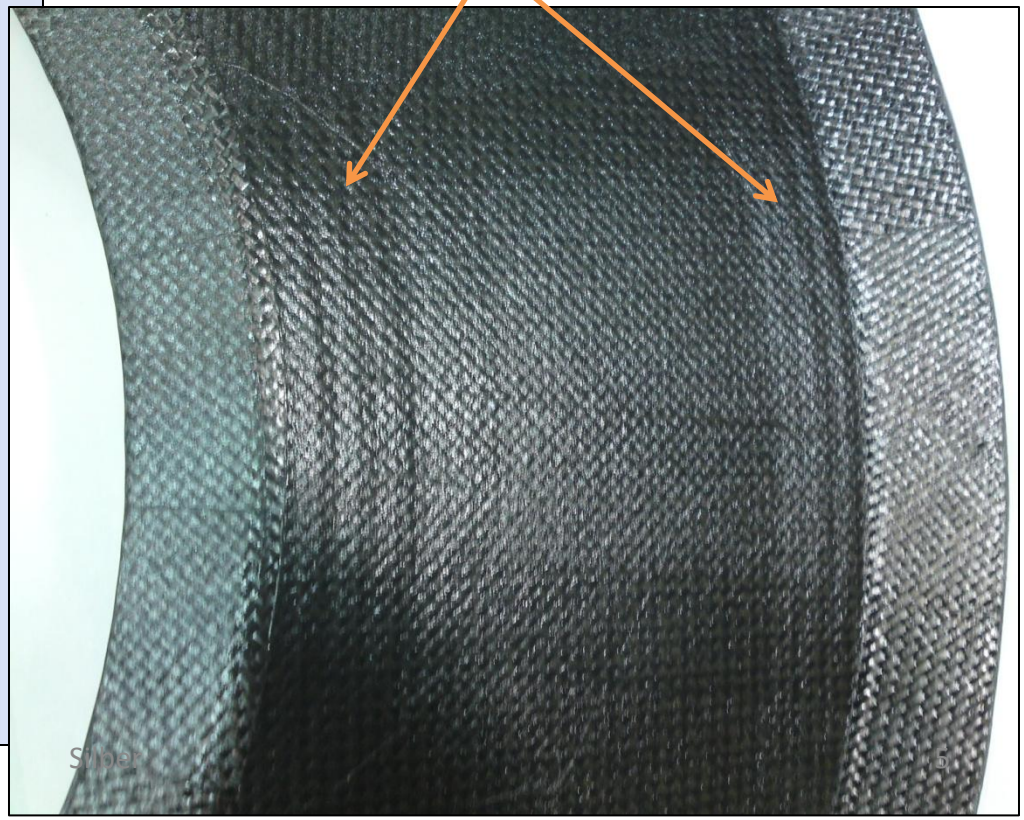


Design the geometry envelope

Design the ply stacking to match

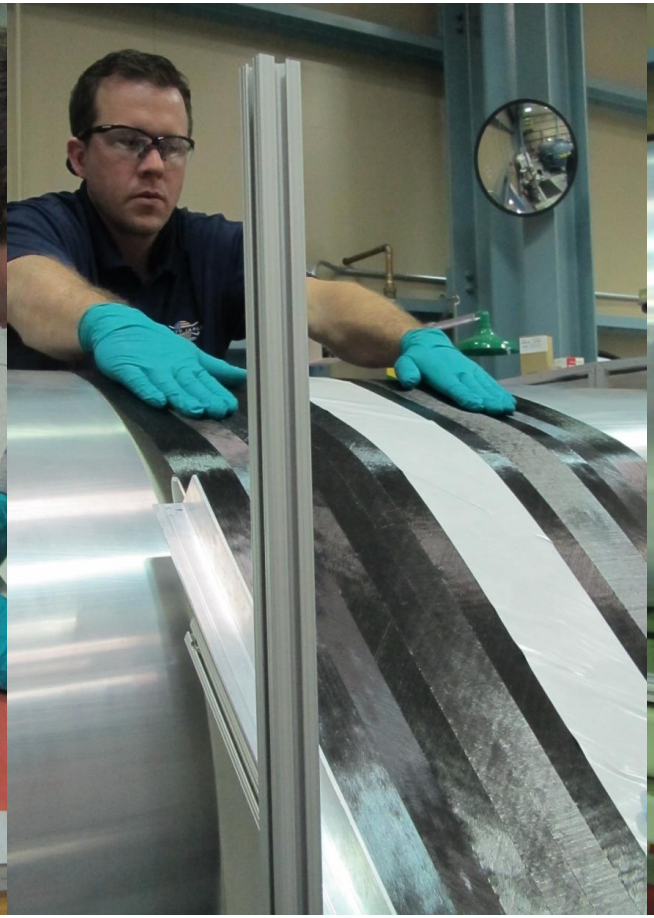
Layup (notice tapering steps)



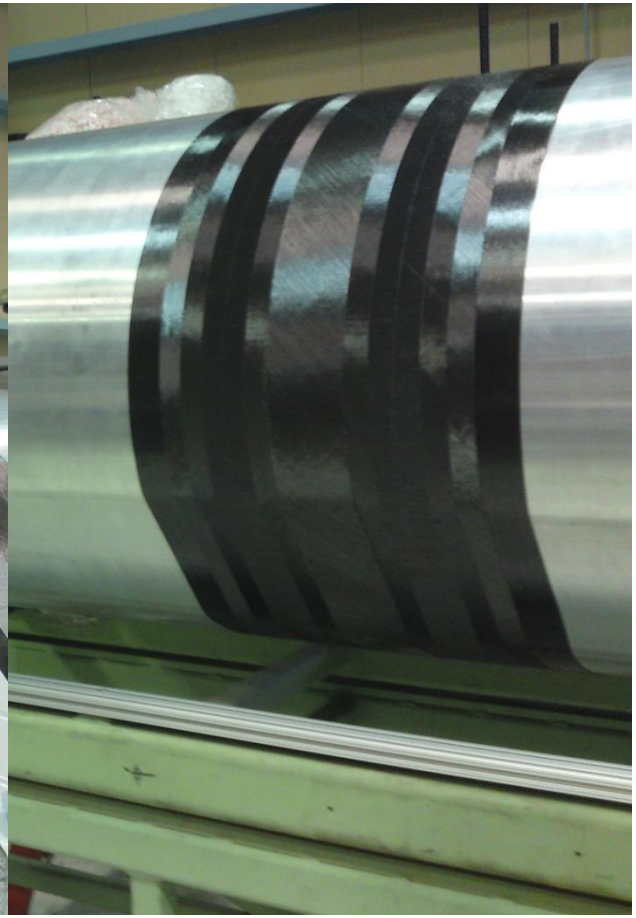


STAR IDS – WSC tube Layup

"Bricking" of ply stack to ensure good overlaps and correct fiber orientations

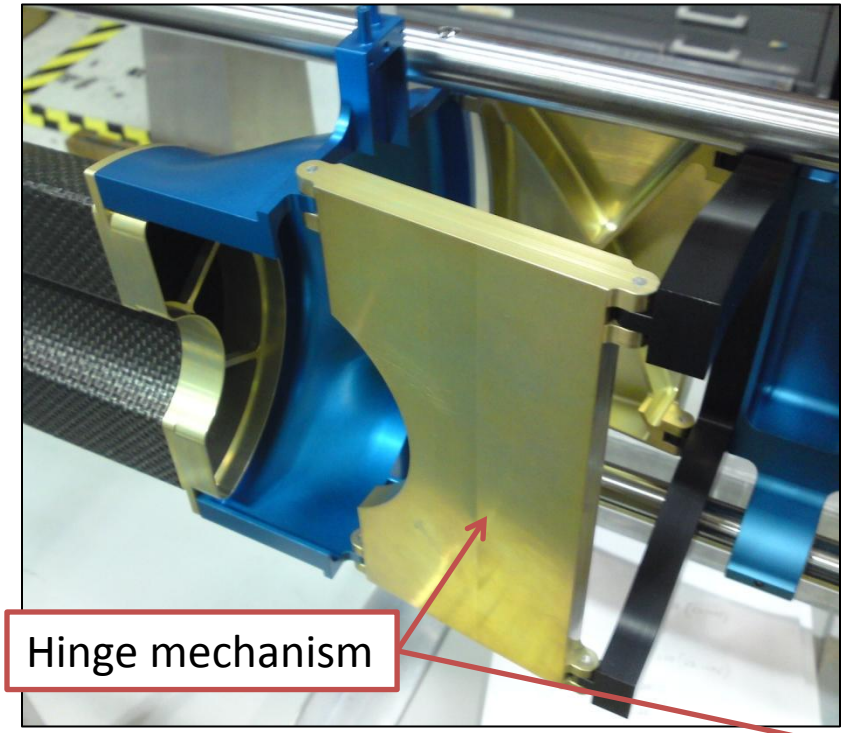


Pre-compacted ply stack goes on mandrel under tension at precise angle

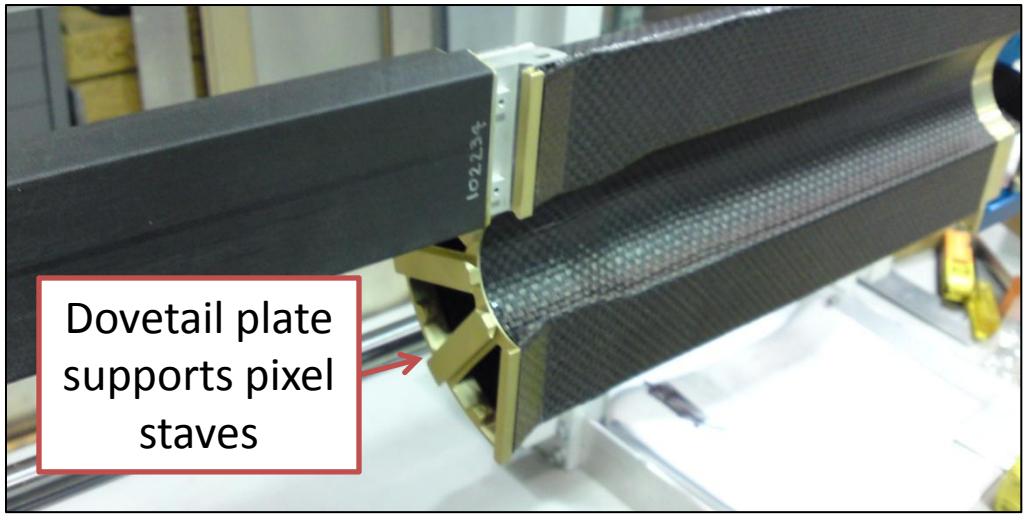


Bottom ply stack on mandrel. Another stack (flipped over) will mate to this one

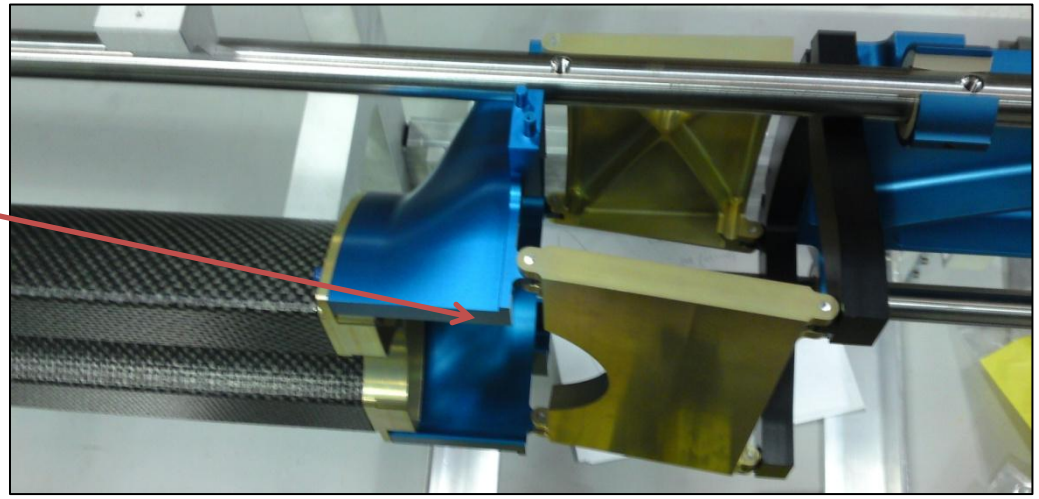
STAR: PXL Insertion Testbed

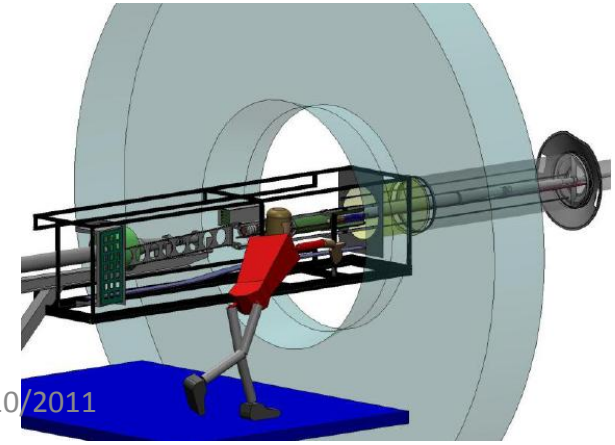


Hinge mechanism



Dovetail plate supports pixel staves

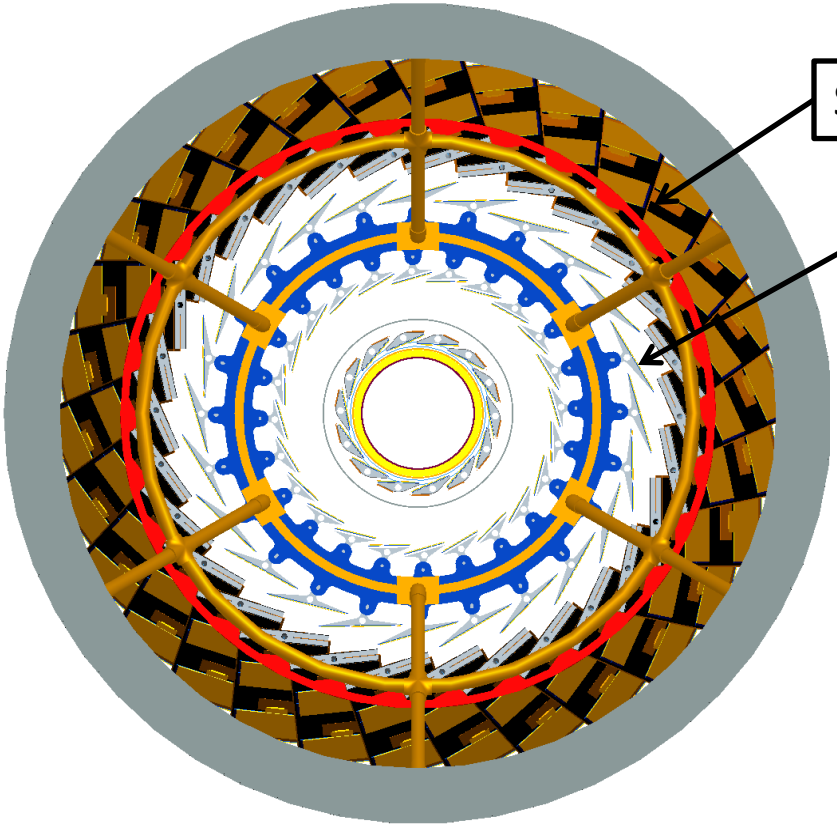




Equipment for large composite parts

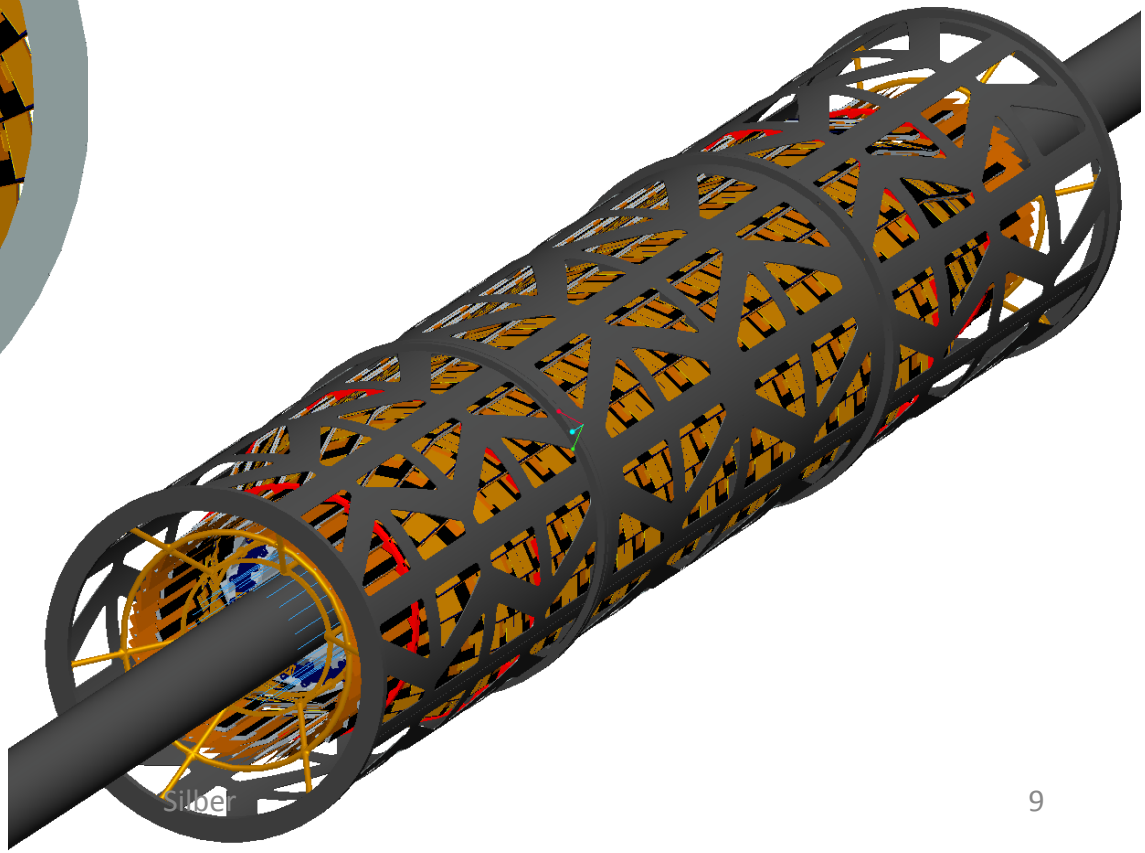
- 5X10 Autoclave, chordal duct
- Part Lengths up to 8.5', diameters up to 40"
- Fully Computer controlled
  - Controls PART Temp—ramps air faster to achieve part temp ramp
  - Internal Pressure and Vacuum bag probes controlled by program
- All sensor data recorded to disk for QC, correlated with Part DB
- Tool and part shown are from ATLAS, 2.4m length

ATLAS Upgrade: Pixel Layout

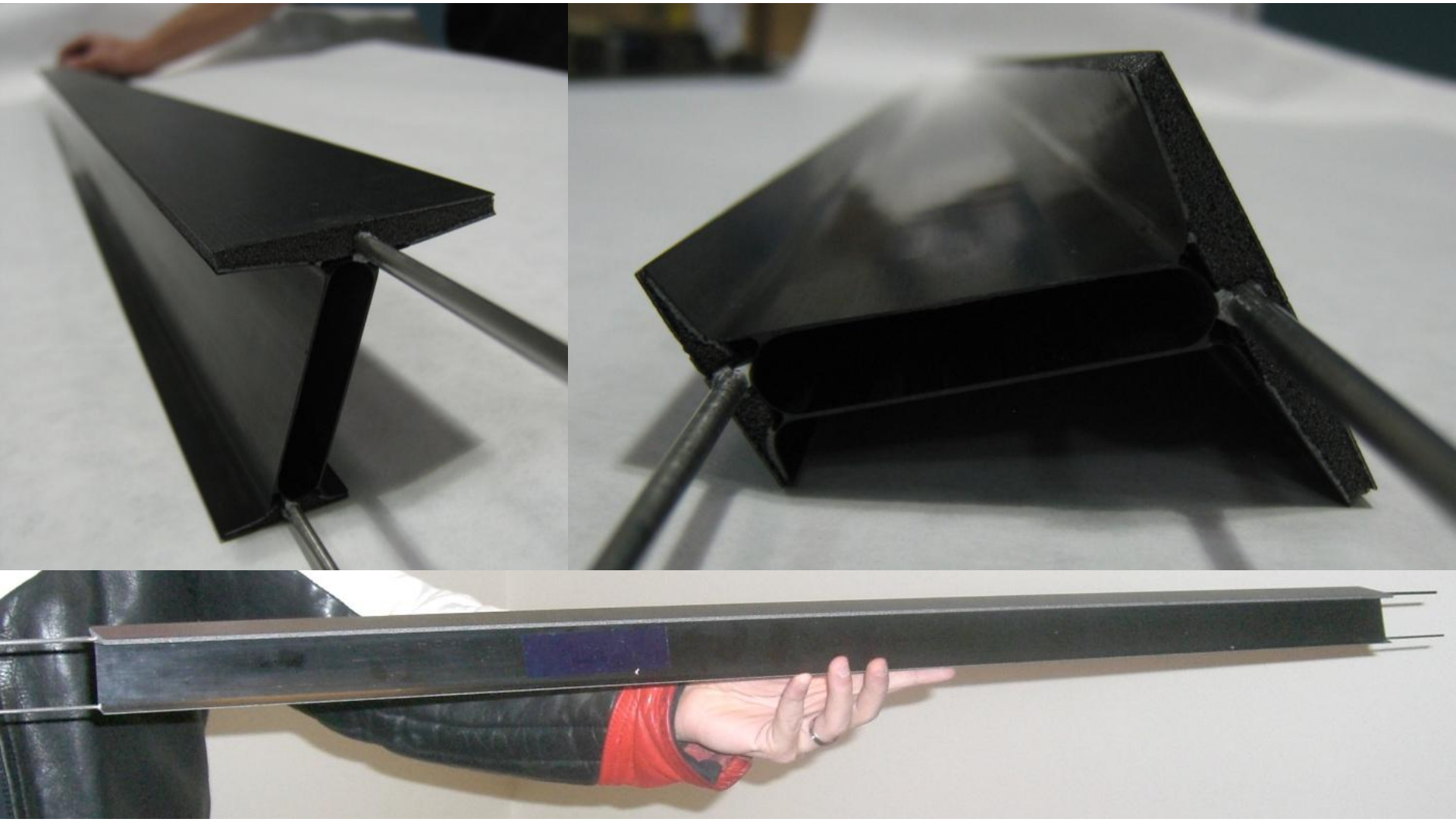


Stave array – 1 layer of silicon

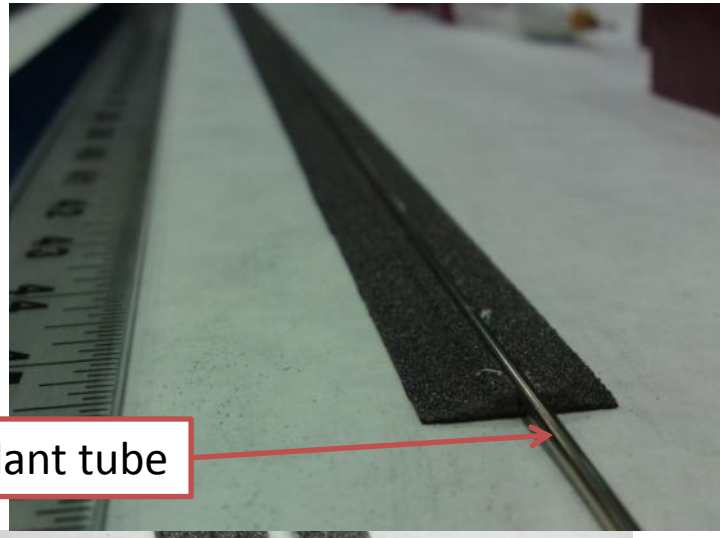
I-Beam array – 2 layers of silicon

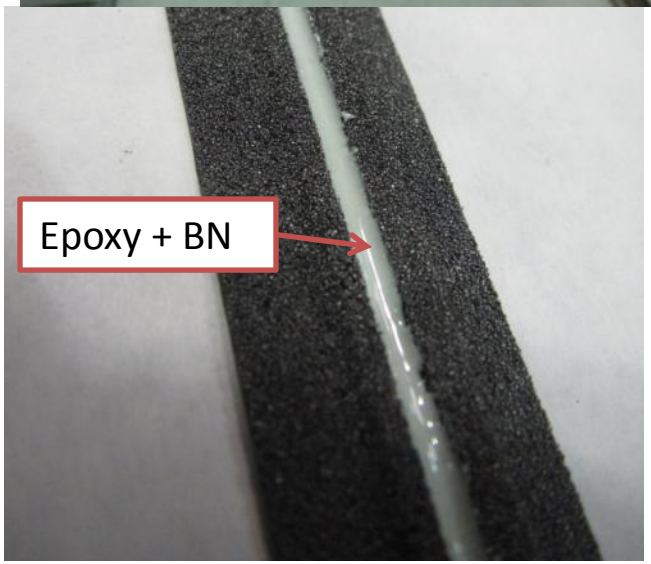


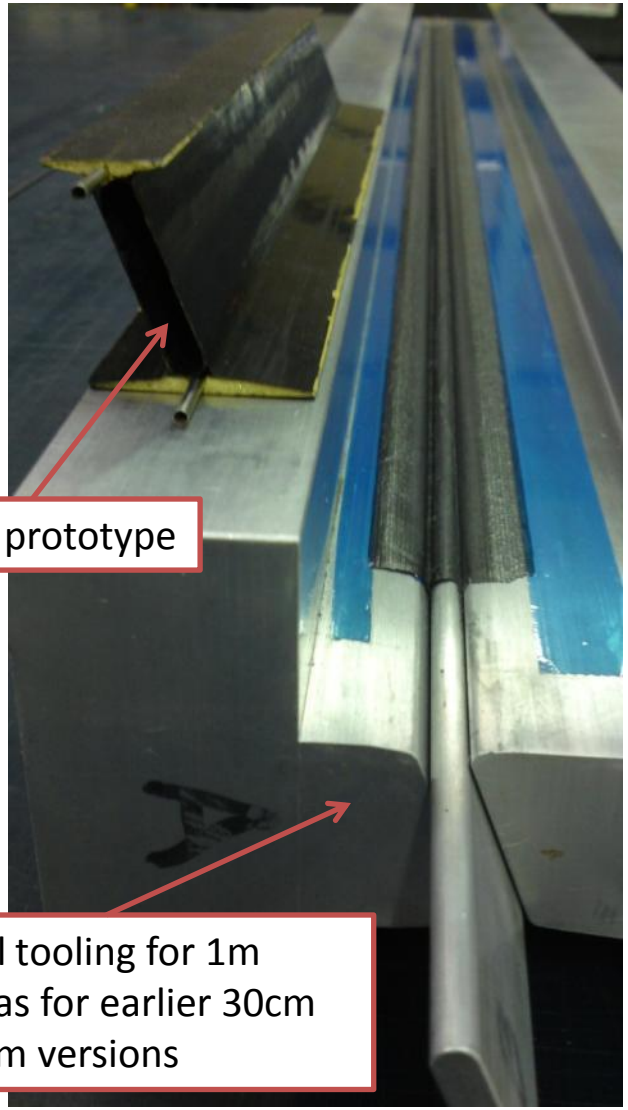
ATLAS Upgrade: 1m I-Beam



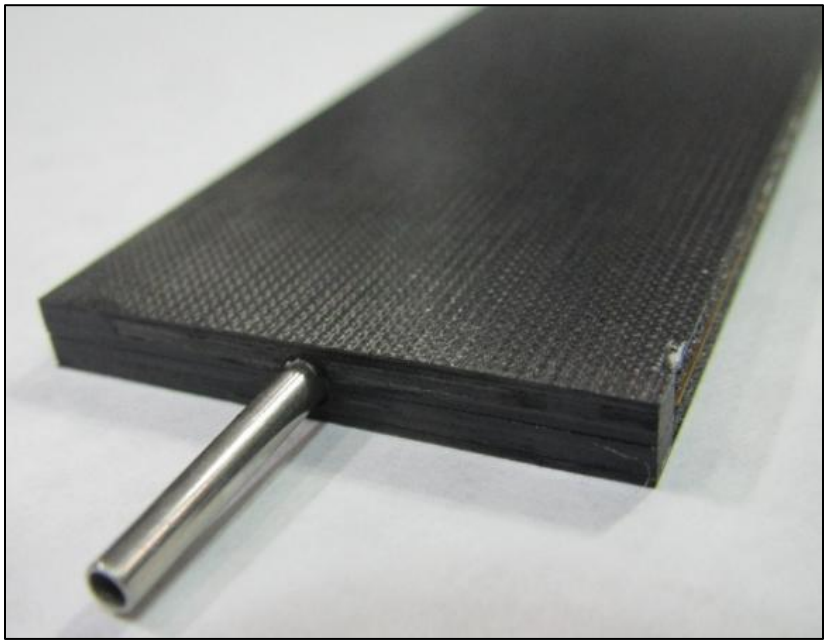
ATLAS Upgrade: I-Beam Fabrication

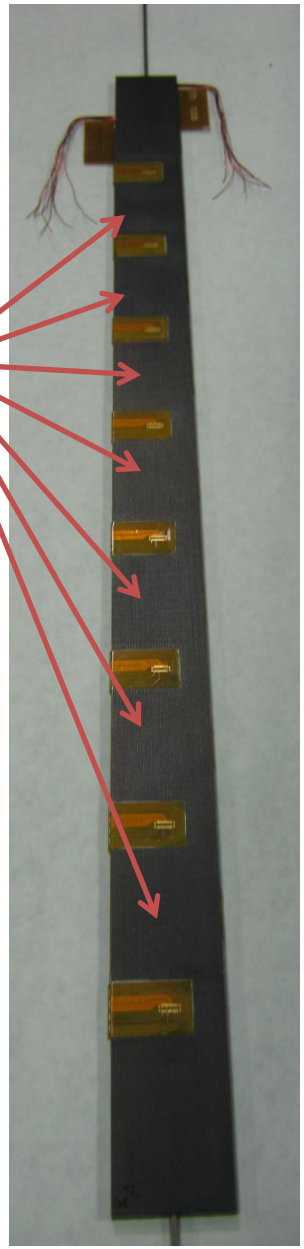


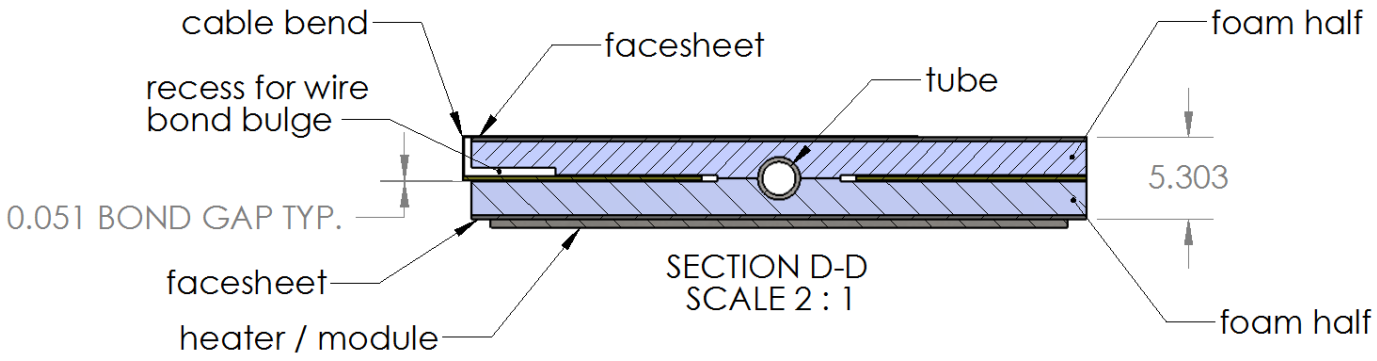




ATLAS Upgrade: Outer Stave

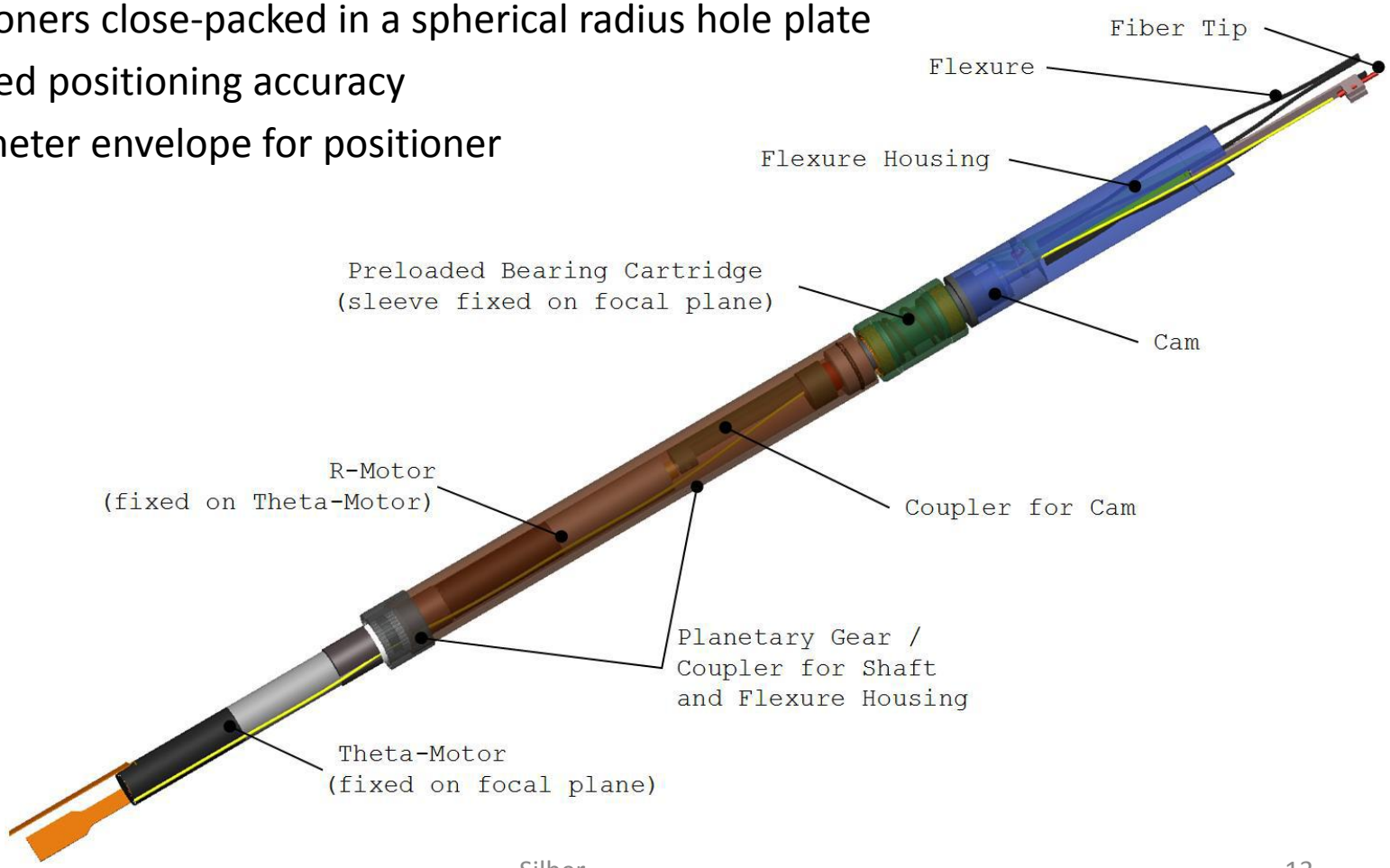




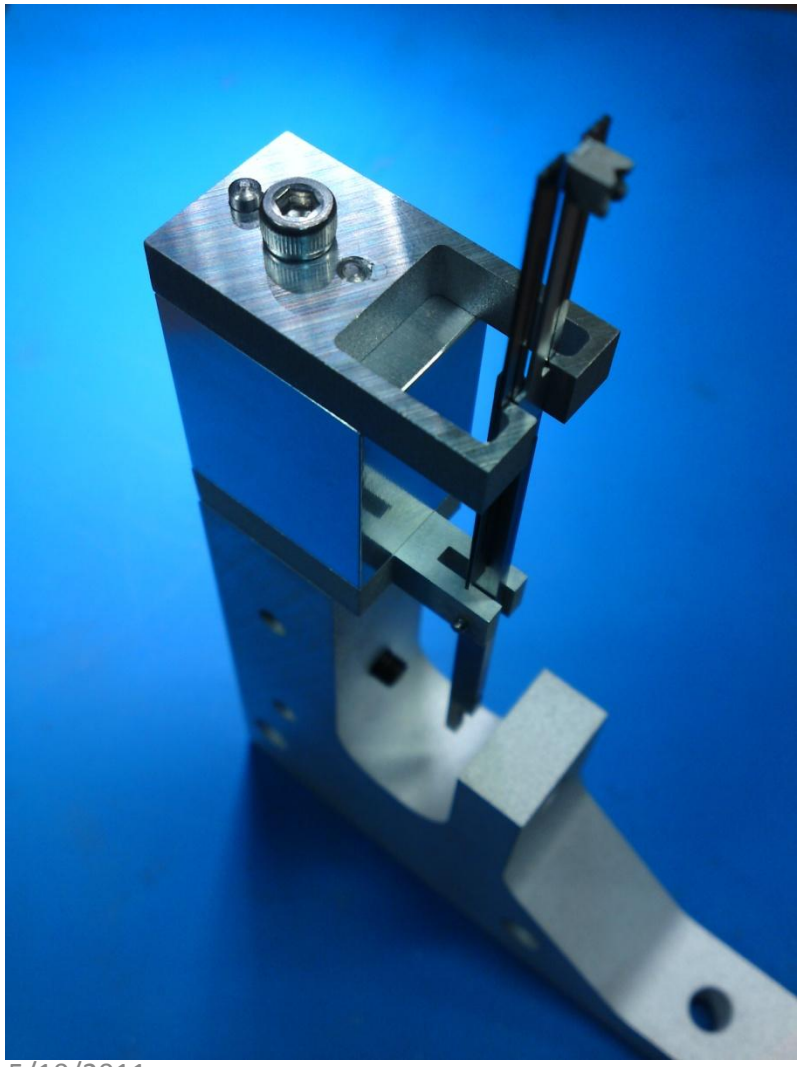


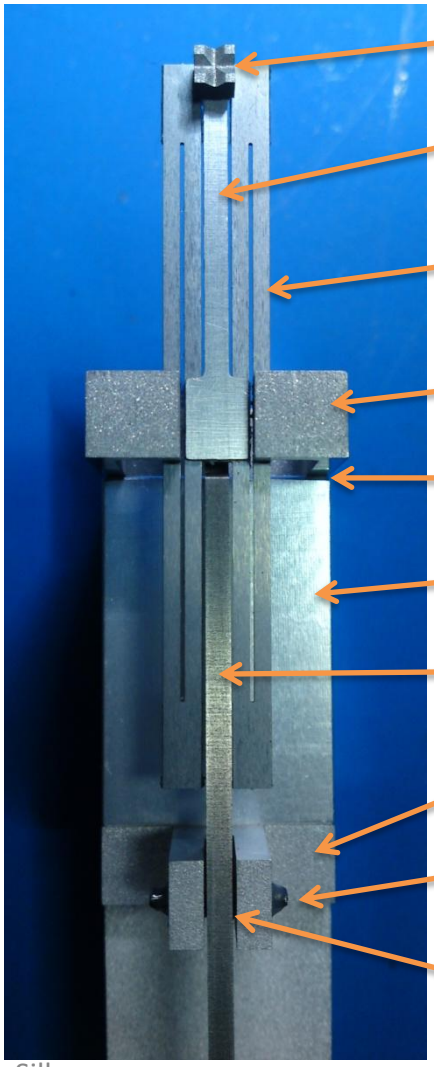
BigBOSS Fiber Positioner

- Positions optical fibers in telescope spectrograph instrument
- 5000 positioners close-packed in a spherical radius hole plate
- 5um required positioning accuracy
- 10mm diameter envelope for positioner



BigBOSS Fiber Positioner: Test Stand + Lever + Flexure





Fiber V block

Fiber arm

Slit H-Flexure (8mm, 17-7PH)

Flexure mount

Shims go here

Spacer

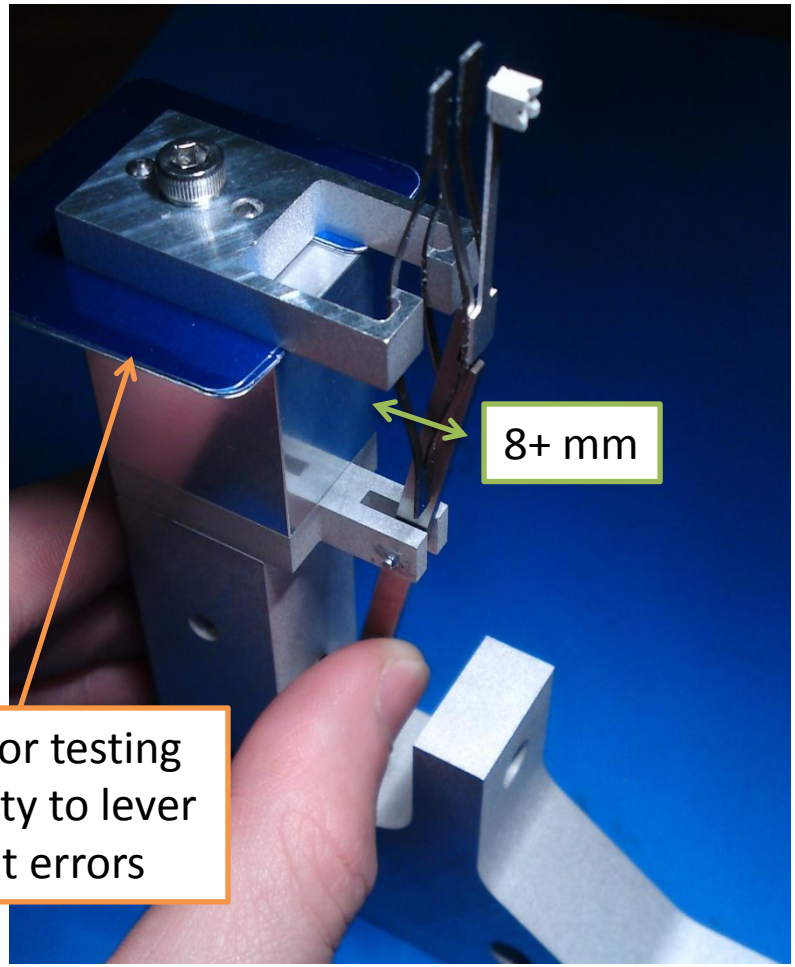
Lever

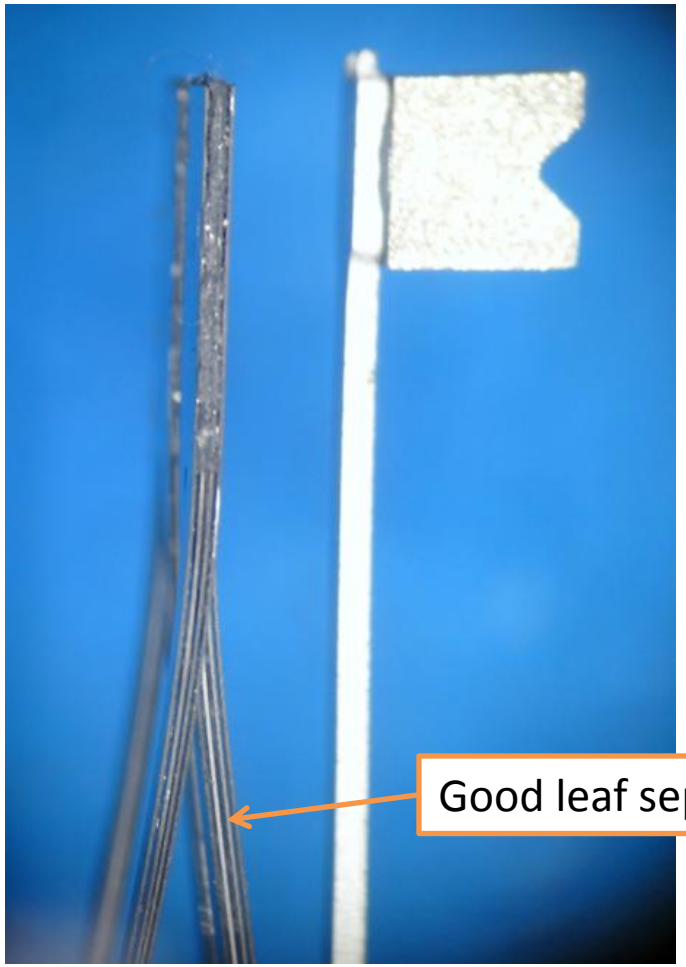
Lever mount

Pin fulcrum

Ring jewel bearings (not visible here)

BigBOSS Fiber Positioner: Flexure Extension





End